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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/259,762	03/01/1999	ZHIPING YIN	303.531US1	5661

21186 7590 04/07/2004

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER


DIAZ, JOSE R

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 04/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/259,762	Applicant(s) YIN ET AL.	
	Examiner José R Díaz	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,5,7-11,21-24,26-28,31-34 and 36-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,5,7-11,21-24,26-28,31-34 and 36-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

The indicated allowability of claims 6, 25 and 35 is withdrawn in view of new rejection based in the combination of references to Knigh et al. (US Pat. No. 5,486,267) and Lin et al. (US Pat. No. 6,143,666). Rejections based on the cited references follow.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 5, 24 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 5, 24, and 34, the independent claims 1, 21 and 31, recites the limitation about using microwave as the energy source for generating the plasma. However, the dependent claims 5, 24, and 34, recites the further limitation of using RF as the energy source, which makes the claim language confusing since it is not clear which of the two is the energy source that applicant intends to claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3, 5, 7-11, 21-24, 26-28, 31-34, and 36-38 are still rejected under 35 U.S.C. 102(e) as being anticipated by Yin et al. (US pat. No. 2002/0140056 A1), previously cited.

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claims 1, 10-11, 21-22, 31-32, Yin et al. teaches a method comprising forming a silicon nitride film (7) on a substrate (see Fig. 5); treating the film in vacuum of about 3.0-6.5 torr (see Table II), for a time of about 10 seconds to about 5 minutes (see Table II and paragraph [0037]), at an energy source of about 150-900 watts (see Table II), and in an atmosphere comprising oxygen plasma having a flow rate of at least about 300 sccm oxygen to about 2000 sccm and helium in concentration of about 400-1000 sccm (see Table II and paragraph [0037]); and forming and patterning a resist layer (3) (see Figs. 7-8).

With regards to the limitation about treating the photoresist layer with UV light, Yin et al. teaches that any well-known technique can be used to treat the photoresist

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(see last sentence in paragraph [0044]). One of ordinary skills in the art recognizes that one of such well-known techniques is, for example, exposing the photoresist layer to UV light. As evidence that using UV light is conventional in the art, the examiner cites Knighth et al. (US Pat. No. 5,486,267), col. 1, lines 12-22 (previously cited); and Wolf et al., "Silicon Processing for the VLSI ERA, Volume 1: Process Technology", Lattice Press, 1986, p. 407 and 427-428 (previously cited).

With regards to the microwave energy, one of ordinary skills in the art recognizes that RF and microwave are the two well-known energy sources for generating plasma. Therefore, these are interchangeable in such a process. As evidence, the examiner cites Spencer (US Pat. No. 4,673,456), lines 13-14 of abstract (previously cited); and Bersin (US Pat. No. 4,699,689), col. 5, lines 56-59.

Regarding claims 3, 23 and 33, Yin et al. further teaches that the electrodes are about 400-600 mils apart (see Table II).

Regarding claims 5, 24 and 34, Yin et al. further teaches that the energy source is RF energy (see Table II).

Regarding claims 7-9, 26-28 and 36-38, Yin et al. further reducing footing and undercutting (see paragraph [0009] and figs. 1-4).

Regarding claim 10, Yin et al. further teaches that the oxygen flow rate is not greater than about 2000 sccm (see Table II).

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3, 5, 7-11, 21-24, 26-28, 31-34, and 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knigh et al. (US Pat. No. 5,486,267) in view of Lin et al. (US Pat. No. 6,143,666), both references were previously cited.

Regarding claims 1, 11, 21-22, 31 and 32, Knight et al. teaches a method for reducing profile distortion in semiconductor fabrication using deep ultraviolet lithography without roughening a semiconductor substrate surface, comprising: providing a semiconductor substrate (14) (see fig. 1) comprising a film comprising silicon-nitride (see col. 1, lines 55-58); exposing oxygen gas (i.e. O₃) (see col. 1, lines 61-64) to an electromagnetic energy (please note that microwave energy is a very well known example of an electromagnetic energy, see col. 1, lines 65-67), generating about 150-

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900 watts (i.e. 400 watts) (see col. 2, lines 45-47) in order to make oxygen plasma (see col. 1, lines 49-51); treating the film for a time of about 10 seconds to about 5 minutes (see col. 2, lines 46-48), and in an atmosphere free of argon (see col. 2, lines 42-49) comprising oxygen plasma (i.e. O_3) as the gas present in the greatest concentration (see col. 2, lines 1-5) wherein the oxygen plasma flow rate is at least about 300 sccm oxygen (i.e. 3900 sccm) (see col. 2, lines 42-49 and col. 3, lines 15-17 and 24-27) and the atmosphere renders the substrate resistant to profile distortion and roughening to make a treated substrate (see col. 2, lines 62-64); applying a resist to the treated substrate (see col. 2, lines 25-27); and treating and patterning the resist with UV light (see col. 1, lines 13-15). In addition, Knight et al. teaches that it is well known in the art to dilute the concentration of the oxygen species, i.e. O_3 , to about 5% by weight by adding helium to the chamber (see col. 2, lines 1-5 and 37-37-39) at a flow rate of, for example, about 1500 sccm (see col. 38-39).

However, Knight et al. fails to teach the limitation of treating the film in a vacuum of about 3.0-6.5 torr.

Lin et al. teaches a very well known oxygen plasma surface treatment which is performed in a vacuum of about 3.0-6.5 torr (consider the pressure of about 7 torr, which reads over the claimed value of about 6.5, see col. 9, lines 9-10).

Knight et al. and Lin et al. are analogous art because they are from the same field of endeavor as applicant's invention. At the time of the invention it would have been obvious to a person of ordinary skill in the art to include a pressure of about 7 torr. The motivation for doing so, as is taught by Lin et al., is proving a treated surface that is

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more receptive to the photoresist layer (col. 8, lines 61-62). Therefore, it would have been obvious to combine Lin et al. with Knight et al. to obtain the invention of claims 1, 3, 5, 7-11, 21-24, 26-28, 31-34, and 36-38.

Regarding claims 3, 23 and 33, Lin et al. teaches that the electromagnetic excitation of oxygen gas is made by electrode spaced to about 180-280 mils (see col. 9, lines 12-15). With regards to the claimed range of about 400-600 mils, it would have been obvious to one of ordinary skill in the art, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) citing *In re Aller*, 105 USPQ 233, 235 (CCPA 1955).

Regarding claims 5, 24 and 34, Knight et al. teaches exposing the oxygen gas (i.e. O₃) to an electromagnetic energy (i.e. RF) (see col. 1, lines 65-67).

Regarding claims 7-8, 26-27, and 36-37, Knight et al. teaches that the reduced profile distortion is footing or undercutting (see col. 1, lines 30-33, col. 2, lines 61-64, and col. 3, lines 15-17 and 25-27).

Regarding claims 9, 28, and 38, Lin et al. teaches the limitation of removing the photoresist (48a-48c) (see figs. 10-11).

Regarding claim 10, Lin et al. teaches an oxygen plasma flow rate of at least about 300 sccm to about 2000 sccm (i.e. 400-600 sccm) (see col. 9, lines 14-15).

Response to Arguments

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Applicant's arguments with respect to claims 1, 3, 5, 7-11, 21-24, 26-28, 31-34, and 36-38 have been considered but are moot in view of the new grounds of rejection.

With regards to the arguments filed on October 14, 2003 against Knigth et al., please note that Knigth et al. does not limit the invention to only that flow rate (col. 3, lines 29-33), but also encompasses other ranges such as the one taught by Lin et al. (see above), as long as the contaminants on the treated film, which are believed to interfere with the photoresist de-protection reaction, are neutralized (col. 3, lines 25-28), thus, resulting in a film in which the profile distortion at the film/photoresist interface is avoided (col. 2, lines 63-64). Please note that this is the same "unexpected" result of Applicant's invention (Page 8, lines 23-26 of Applicant's Specification).

Thus, in absence of any evidence showing that the claimed process parameters achieve unexpected results relative to the prior art ranges, the examiner consider that those claimed parameters are merely optimum or working ranges. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Huang*, 40 USPQ2d 1685,1688(Fed. Cir. 1996) citing *In re Aller*, 105 USPQ 233., 235 (CCPA 1955). Therefore, the rejections, as presented in this Office action, are considered to be proper.

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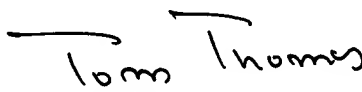
Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R Díaz whose telephone number is (571) 272-1727. The examiner can normally be reached on 9:00-5:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JRD
4/2/04


Tom Thomas
Supervising Patent Examiner
Art Unit 2815